

Claims

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1. A grain drill comprising:  
    a frame having a plurality of wheels for  
    supporting the grain drill during rolling over  
5    a surface of ground to be planted with grain;  
    a hopper for containing the seed grain to be  
    planted in the ground;  
    a support which is joined to opposed sides of  
    the frame and to spaced apart locations of the hopper  
10   to transfer weight of the hopper to the frame, the  
    support including at least one weight sensing device  
    which senses a weight of seed grain in the hopper  
    transferred through the support to the frame and  
    provides an output of the sensed weight of the seed  
15   grain in the hopper; and  
    a display, coupled to the output, for  
    displaying the weight of the seed grain contained in  
    the hopper.
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2. A grain drill in accordance with claim 1  
20   wherein the support comprises:  
    a pair of weight bearing supports which are  
    respectively joined to the opposed sides of the frame,  
    each weight bearing support including first and second  
    vertical parts which are respectively attached to the  
25   hopper at the spaced apart locations separated along  
    a longitudinal dimension of the grain drill and  
    a horizontal part joined to the vertical parts and  
    attached to the frame.

3. A grain drill in accordance with claim 2  
wherein:

the at least one weight sensing device  
comprises first and second load cells associated with  
5 each of the pair of weight bearing supports, the first  
load cell being loaded with weight transferred from the  
first vertical part to the horizontal part and the  
second load cell being loaded with weight transferred  
from the second vertical part to the horizontal part.

10 R 20 4. A grain drill in accordance with claim 3  
wherein:

a first end of the first and second vertical  
parts is attached to the hopper and a second end of the  
first and second vertical parts is respectively  
15 attached to spaced apart locations of the horizontal  
part to transfer the weight of the seed grain in the  
hopper to the horizontal part; and  
the horizontal part has first and second  
horizontal extensions, the first horizontal extension  
20 having a first end which is coupled to the frame and  
includes the first load cell and a second end which is  
deflected downward by the weight of the seed grain in  
the hopper and which is attached to the second end of  
the first vertical part and the second horizontal  
25 extension having a first end which is coupled to the  
frame and includes the second load cell and a second  
end which is deflected downward by the weight of the  
seed grain in the hopper and which is attached to the  
second end of the second vertical part.

3. A grain drill in accordance with claim 1  
wherein:

the support frame includes at each of the opposed sides a horizontal member, each horizontal member having at least first and second spaced apart holes extending vertically through the horizontal member and which respectively receive and allow vertical movement of a portion of the first and second vertical parts therein, the holes restricting horizontal movement of the hopper relative to the frame by confining the portion of the first and second vertical parts to within the holes.

4. A grain drill in accordance with claim 3  
wherein the first and second vertical parts comprise:

a horizontal piece attached to one end of a vertical piece and another end of the vertical piece being the second end of the vertical part, at least one connector extending from the horizontal piece and through one of the holes and being vertically moveable therein and into engagement with the hopper.

5. A grain drill in accordance with claim 4  
wherein:

a pair of connectors extend from the horizontal piece at opposed ends thereof spaced from a point of attachment of the vertical piece to the horizontal piece.

6. A grain drill in accordance with claim 6  
wherein:

each connector is threaded and engages threads in the hopper at one of the spaced apart positions of the hopper.

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9. A grain drill in accordance with claim <sup>5</sup>~~8~~
- wherein:

the pair of connectors are threaded and  
respectively engage threads in the hopper at one of the  
5 spaced apart ~~locations~~ positions of the hopper.

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10. A grain drill in accordance with claim <sup>4</sup>~~8~~
- wherein:

a bushing is located in each hole and  
securely engages each connector to prevent horizontal  
10 movement of the engaged connector relative to the  
bushing.

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11. A grain drill in accordance with claim <sup>5</sup>~~8~~
- wherein:

a bushing is located in each hole and  
15 securely engages each connector to prevent horizontal  
movement of the engaged connector relative to the  
bushing.

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12. A grain drill in accordance with claim <sup>6</sup>~~8~~
- wherein:

a bushing is located in each hole and  
securely engages each connector to prevent horizontal  
20 movement of the engaged connector relative to the  
bushing.

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13. A grain drill in accordance with claim <sup>10</sup>~~8~~

25 wherein:

a bushing is located in each hole and  
securely engages each connector to prevent horizontal  
movement of the engaged connector relative to the  
bushing.

*22*  
14. A grain drill in accordance with claim 1  
 wherein:

the spaced apart locations are located at  
 four corners of the hopper and the support is attached  
 5 to the four corners by engagement with a bottom part of  
 the hopper.

15. A grain drill in accordance with claim 2  
 wherein:

10 the spaced apart locations are located at  
 four corners of the hopper and the support is attached  
 to the four corners by engagement with a bottom part of  
 the hopper.

16. A grain drill in accordance with claim 3  
 wherein:

15 the spaced apart locations are located at  
 four corners of the hopper and the support is attached  
 to the four corners by engagement with a bottom part of  
 the hopper.

*21*  
17. A grain drill in accordance with claim 4  
 20 wherein:

the spaced apart locations are located at  
 four corners of the hopper and the support is attached  
 to the four corners by engagement with a bottom part of  
 the hopper.

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18. A grain drill in accordance with claim 5  
 wherein:  
 the spaced apart locations are located at  
 four corners of the hopper and the support is attached  
 to the four corners by engagement with a bottom part of  
 30 the hopper.

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19. A grain drill in accordance with claim 8  
wherein:

the spaced apart locations are located at  
four corners of the hopper and the support is attached  
5 to the four corners by engagement with a bottom part of  
the hopper.

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20. A grain drill in accordance with claim 8  
wherein:

the spaced apart locations are located at  
10 four corners of the hopper and the support is attached  
to the four corners by engagement with a bottom part of  
the hopper.

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21. A grain drill in accordance with claim 8  
wherein:

15 the spaced apart locations are located at  
four corners of the hopper and the support is attached  
to the four corners by engagement with a bottom part of  
the hopper.

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22. A grain drill in accordance with claim 8  
20 wherein:

the spaced apart locations are located at  
four corners of the hopper and the support is attached  
to the four corners by engagement with a bottom part of  
the hopper.

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- 25 23. A grain drill in accordance with claim 10  
wherein:

the spaced apart locations are located at  
four corners of the hopper and the support is attached  
to the four corners by engagement with a bottom part of  
30 the hopper.

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- ~~24.~~ A grain drill in accordance with claim ~~11~~  
wherein:

the spaced apart locations are located at  
four corners of the hopper and the support is attached  
5 to the four corners by engagement with a bottom part of  
the hopper.

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- ~~25.~~ A grain drill in accordance with claim ~~22~~  
wherein:

the spaced apart locations are located at  
10 four corners of the hopper and the support is attached  
to the four corners by engagement with a bottom part of  
the hopper.

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- ~~26.~~ A grain drill in accordance with claim ~~10~~  
wherein:

15 the spaced apart locations are located at  
four corners of the hopper and the support is attached  
to the four corners by engagement with a bottom part of  
the hopper.

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- ~~27.~~ A grain drill in accordance with claim ~~11~~  
20 wherein:

each weight bearing support is mounted to not  
extend in a direction along a width of the grain drill  
beyond a width of a portion of the frame to which the  
weight bearing support is attached.

- ~~25. 26. 27. 28.~~ A grain drill in accordance with claim ~~2~~

wherein:

at least one weight bearing support has at  
least a part extending in a direction along a width of  
the grain drill part extending beyond a width of  
30 a portion of the frame to which the weight bearing  
support is attached.

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29. A method for modifying a grain drill having a frame having a plurality of wheels for supporting the grain drill during rolling over a surface of ground to be planted with seed grain and a hopper joined to the frame for containing the seed grain to be planted comprising:
- raising the hopper upward from the frame to separate the hopper from being joined to the frame;
- positioning a support between the hopper and the frame to join the support to opposed sides of the frame and to spaced apart positions of the hopper to support the hopper in a raised position above the frame, the positioned support transferring weight of the hopper to the frame and including at least one weight sensing device which senses a weight of the seed grain in the hopper transferred through the support to the frame and which provides an output of the sensed weight of the seed grain in the hopper; and
- providing a display on the grain drill for displaying the weight of the seed grain contained in the hopper.

30. A method in accordance with claim 29 wherein the support comprises:

- a pair of weight bearing supports which are respectively joined to the opposed sides of the frame, each weight bearing support including first and second vertical parts which are respectively attached to the hopper at the spaced apart locations separated along a longitudinal dimension of the grain drill and
- a horizontal part joined to the vertical parts and attached to the frame.

31. A method in accordance with claim 30 wherein:  
the at least one weight sensing device  
comprises first and second load cells associated with  
each of the pair of weight bearing supports, the first  
5 load cell being loaded with weight transferred from the  
first vertical part to the horizontal part and the  
second load cell being loaded with weight transferred  
from the second vertical part to the horizontal part.

32. A method in accordance with claim 31 wherein:  
10 a first end of the first and second vertical  
parts is attached to the hopper and a second end of the  
first and second vertical parts are respectively  
attached to spaced apart locations of the horizontal  
part to transfer the weight of the seed grain in the  
15 hopper to the horizontal part;  
the horizontal part has first and second  
horizontal extensions, the first horizontal extension  
having a first end which is coupled to the frame and  
includes the first load cell and a second end which is  
20 deflected downward by the weight of the seed grain in  
the hopper and which is attached to the second end of  
the first vertical part and the second horizontal  
extension having a first end which is coupled to the  
frame and includes the second load cell and a second  
25 end which is deflected downward by the weight of the  
seed grain in the hopper and which is attached to the  
second end of the second vertical part.

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- ~~33.~~ A method in accordance with claim ~~32~~ wherein:  
 the ~~support~~ frame includes at each of the  
 opposed sides a horizontal member, each horizontal  
 member having at least first and second spaced apart  
 5 holes extending vertically through the horizontal  
 member and which respectively receive and allow  
 vertical movement of a portion of the first and second  
 vertical parts therein, the holes restricting  
 horizontal movement of the hopper relative to the frame  
 10 by confining the portion of the first and second  
 vertical parts to within the holes.

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- ~~34.~~ A method in accordance with claim ~~33~~ wherein:  
 a horizontal piece attached to one end of  
 a vertical piece and another end of the vertical piece  
 being the second end of the vertical part, at least one  
 connector extending from the horizontal piece and  
 through one of the holes and being vertically moveable  
 therein and into engagement with the hopper.

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- ~~35.~~ A method in accordance with claim ~~34~~ wherein:  
 20 a pair of connectors extend from the  
 horizontal piece at opposed ends thereof spaced from  
 a point of attachment of the vertical piece to the  
 horizontal piece.

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- ~~36.~~ A method in accordance with claim ~~35~~ wherein:  
 25 the pair of connectors are threaded and  
 respectively engage threads in the hopper at one of the  
 spaced apart positions of the hopper.

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- ~~37.~~ A method in accordance with claim ~~35~~ wherein:  
 a bushing is located in each hole and  
 30 securely engages each connector to prevent horizontal  
 movement of the engaged connector relative to the bushing.

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38. A method in accordance with claim 36 wherein:  
 a bushing is located in each hole and  
 securely engages each connector to prevent horizontal  
 movement of the engaged connection relative to the  
 bushing.

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39. A grain drill in accordance with claim 29  
 wherein:

the spaced apart locations are located at  
 four corners of the hopper and the support is attached  
 10 to the four corners by engagement with a bottom part of  
 the hopper.

40. A grain drill in accordance with claim 29  
 wherein:

each weight bearing support is mounted to not  
 15 extend in a direction along a width of the grain drill  
 beyond a width of a portion of the frame to which the  
 weight bearing support is attached.

41. A grain drill in accordance with claim 29  
 wherein:

20 at least one weight bearing support has at  
 least a part extending in a direction along a width of  
 the grain drill part extending beyond a width of  
 a portion of the frame to which the weight bearing  
 support is attached.

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